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10/759,059

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EXAMINER

LAFOND, RONALD D

ART UNIT

PAPER NUMBER

1762

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/759,059

Applicant(s)

LEE ET AL.

Examiner

Ronald D. Lafond

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 20 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application:
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 05/08/2006
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION*****Claim Objections***

1. Claim 1 is objected to because of the following informalities: Improper grammar. The phrase "forming a film by coating liquid organic-based solution on the surface of glass substrates" should read, "forming a film by coating ***the surface of glass substrates with a liquid organic-based solution***" or some such equivalent language. Furthermore, the phrase "applying heat treatment on the substrates" should read "applying heat treatment ***to*** the substrates." Appropriate correction is required.
2. Claims 4 and 15 are objected to because of the following informalities: Improper grammar. The phrase "with an appropriate temperature" in these Claims should read, "***at*** an appropriate temperature." Appropriate correction is required.
3. Claims 5, 11, 16, and 22 are objected to because of the following informalities: Claims must each be only one sentence (see MPEP 608.01(m), particularly that "Each claim begins with a capital letter and ends with a period. Periods may not be used elsewhere in the claims except for abbreviations"). Appropriate correction is required.
4. Claims 9 and 20 are objected to because of the following informalities: Improper grammar. The phrase "wherein said organic-based spin-on-glass has two functional groups of side-link  $R_1$  and  $R_2$  after cross-linking and solidification" in these Claims should read, "wherein said organic-based spin-on-glass has ***two side-linked functional groups  $R_1$  and  $R_2$***  after cross-linking and solidification" or some such equivalent language. Appropriate correction is required.
5. Claims 10 and 21 are objected to because of the following informalities: Improper grammar. The phrase "wherein the  $R_1$  and  $R_2$  independently represent the functional group selected from H,  $CH_3$ ..." in these Claims should read, "wherein  ***$R_1$  and  $R_2$  are independently selected from the functional groups of H,  $CH_3$ , ...***" Appropriate correction is required.
6. Claim 12 is objected to because of the following informalities: Improper grammar. The phrase "applying heat treatment for the glass microchannels" should read, "applying heat treatment ***to*** the glass microchannels." Appropriate correction is required.

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7. Claim 19 is objected to because of the following informalities: a word is omitted. Neither the word "and" nor the word "or" appears in the listing of gases that may comprise the inert gas. To give the claim its broadest reasonable interpretation, Claim 19 will be interpreted as including the word "or" in the listing of inert gases as in Claim 8.

***Claim Rejections - 35 USC § 112***

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 4, 6, 7, 11, 14, 15, 17, 18, and 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. Regarding Claims 4 and 15, the terms "high temperature" and "appropriate temperature" are relative terms which render these Claims indefinite. These terms are not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. For the purposes of compact prosecution, the Examiner will interpret these terms to be inclusive of all temperatures at which spin-on-glass curing processes may successfully be performed.

11. Claims 6 and 17 recite the limitation "wherein said step of heat treatment is conducted" in "the air." There is insufficient antecedent basis for this limitation in the claim.

12. Claims 7 and 18 recite the limitations "wherein said step of heat treatment is conducted" in "the inert gas environment." There is insufficient antecedent basis for this limitation in the claim.

13. Claims 11 and 22 reference a glass substrate from their parent Claims. However, these Claims allow for the use of substrate materials – silicon, silicon nitride, metal, and ceramics – that are not glass, which renders these Claims indefinite.

14. Claim 14 recites the limitation "said organic-based spin-on-glass" in Claim 12. There is insufficient antecedent basis for this limitation in the claim.

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***Claim Rejections - 35 USC § 102***

15. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

16. Claims 1, 6, 11, 12, 17, and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Yang, et al. (United States Patent 6,326,083, hereafter Yang).

17. Regarding Claims 1 and 12, Yang teaches a method of modification for the surface of glass substrates comprising the following steps: forming a film by coating liquid organic-based solution on the surface of glass substrates (see Column 11, lines 61 – 67, and Column 12, lines 1 – 8) by filling a liquid organic-based solution in glass microchannels (see Column 2, lines 51 – 55) and removing the superfluous organic-based liquid (see Column 12, lines 8 – 10); and applying heat treatment to the glass microchannel substrates coated with the organic-based solution/polymer to cross-link and solidify the liquid materials (see Column 12, lines 10 – 13).

18. Regarding Claims 6 and 17, Yang teaches the method wherein said step of heat treatment is conducted in the air (see Column 12, lines 10 – 13).

19. Regarding Claims 11 and 22, Yang teaches the method wherein the material of said glass substrate microchannels is an other glass material (see Column 6, lines 51 – 53).

***Claim Rejections - 35 USC § 103***

20. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

21. Claims 2 – 4, 9, 13 – 15, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang in view of Livesay, et al. (United States Patent 6,132,814, hereafter Livesay).

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22. Regarding Claims 2, 3, 13, and 14, Yang does not teach the method wherein said liquid organic-based solution is an organic-based spin-on-glass mainly composed of siloxane. However, Livesay teaches just such a limitation, wherein a liquid organic-based solution which is an organic-based spin-on-glass mainly composed of siloxane is used for the formation of films that modify the surface of substrates (see Column 1, lines 27 – 29, 41 – 44, and 61 – 63). Moreover, Yang teaches, in Column 1, lines 12 – 18, that “active capillary and channel surfaces in separation devices can create problems in virtually any separation methodology ... The charged surfaces of the capillaries and channels of these separation devices are particularly problematic in the separation of charged analytes such as proteins, peptides, and nucleic acids,” and, further, in Column 1, lines 29 – 59, that “silica-based capillaries utilized in capillary electrophoresis have been modified with a range of coatings intended to prevent the adsorption of charged analytes to the walls of the capillaries ... Other chemical modifications of the capillary have also been employed, such as ... polysiloxanes.” Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Yang by utilizing a liquid organic-based spin-on-glass mainly composed of siloxane as the surface modification agent as taught by Livesay with a reasonable expectation of success, because Yang teaches that polysiloxanes are a known chemical modifying agent for capillaries used in microfluidic devices and because Livesay teaches that spin-on-glasses composed mainly of siloxane offer many process benefits over other well-known surface treatment/coating methods (see Column 1, lines 25 – 29).

23. Regarding Claims 9 and 20, Livesay inherently teaches the method wherein said organic-based spin-on-glass has two side-linked functional groups  $R_1$  and  $R_2$  after cross-linking and solidification, as all siloxane polymers must be tetra-valent.

24. Regarding Claims 4 and 15, Yang does not teach the method wherein the step of heat treatment is to put the glass substrates coated with polymer in a high temperature furnace at an appropriate temperature for a period of time. However, Livesay implicitly teaches just such a limitation, wherein curing of the siloxane polymer network is performed at very high temperatures (see Column 1, lines 63 – 67, and Column 2, lines 1 – 2), which necessarily must occur in a high temperature furnace. As mentioned, Yang teaches that the silylation reagent is cured after it is used to treat the surface of capillaries (see Column

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12, lines 7 – 13). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Yang in view of Livesay by curing the siloxane network at a high temperature as taught by Livesay with a reasonable expectation of success, because Livesay teaches that it is known in the art to cure siloxane spin-on-glass coatings in such a manner.

25. Claims 5, 7, 8, 16, 18, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang in view of Livesay, and further in view of Chen, et al. (United States Patent 5,286,675, hereafter Chen).

26. Regarding these Claims, Yang in view of Livesay does not explicitly teach the method wherein the temperature during the step of heat treatment is 425 C and wherein said step of heat treatment is conducted in an inert gas environment comprising nitrogen. However, Chen teaches all of these limitations in a method in which a spin-on-glass siloxane layer is formed via liquid deposition and then heat treated/cured (see Column 2, lines 55 – 61, and especially Column 3, lines 7 – 16). Furthermore, Livesay does teach that spin-on-glass curing typically takes place at temperatures less than 450 C (see Column 1, lines 66 and 67, and Column 2, lines 1 and 2) for integrated circuit fabrication. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Yang in view of Livesay by performing the heat treatment/curing step at 425 C in an inert nitrogen ambient as taught by Chen with a reasonable expectation of success, because Chen teaches that it is known in the art to do so and because Chen teaches, in Column 3, lines 9 – 11, that “a curing step in a nitrogen or other inert atmosphere densifies as well as cures the spin-on-glass layer to a silicon oxide structure.”

27. Claims 10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang in view of Livesay, and further in view of Chua, et al. (Chua, C.T., Sarkar, G., and Hu, X., “In Situ Characterization of Methylsilsesquioxane Curing,” *Journal of the Electrochemical Society*, **145** (11) : 4007 – 4011, November, 1998, hereafter Chua).

28. Regarding these Claims, Yang in view of Livesay does not teach the method wherein the R<sub>1</sub> and R<sub>2</sub> independently represent the functional group of CH<sub>3</sub>. However, Chua teaches just such a limitation,

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wherein methylsilsesquioxane polymers are used as the precursors in spin-on-glass/polymer liquid coating processes (see Introduction on p. 4007, Experimental on pp. 4007 and 4008, and Figures 1 and 2). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Yang in view of Livesay by using a methylsilsesquioxane spin-on-glass precursor as taught by Chua with a reasonable expectation of success, because Chua teaches that such precursors are known and because Livesay stipulates that siloxane is but one example of a silicon-oxygen network of polymers that may be used as spin-on-glass materials (see Column 1, lines 41 – 44).

### **Conclusion**

29. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ronald D. Lafond whose telephone number is (571) 270-1878. The examiner can normally be reached on M-F 7:30-5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RDL

  
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SUPERVISORY PATENT EXAMINER